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Novel methods for sampling raw beef trim for microbiological testing (#394)

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Introduction

The risk of meat contamination with foodborne pathogens is one of the biggest challenges to the meat industry. Beef trim sampling for pathogen testing is one of the final steps in meat safety systems. N60 excision and N60 plus have traditionally been used to sample beef trim for pathogen testing. However, a sampling method that represents a greater proportion of the beef trimmings in a 900-kg combo bin should improve the current pathogen sampling and detection programs utilized by fresh beef processors. We have developed two rapid, non-destructive approaches for sampling beef trim that provide a sample that represents a much greater proportion of the trim in the combo bin. A continuous sampling device (CSD) is positioned at the end of the conveyor line so that the trim pieces rub against a sampling cloth as they fall into the combo bin. For situations where the combo is not filled by a conveyor, a second method was developed that uses the same CSD cloth to manually sample all of the trim on the top of the combo by hand (manual sampling device [MSD]). The objective of this work was to collect additional validation data for the new sampling methods compared to the existing sampling methods.

Methods

This project was designed to compare four different sample collection methods used in pathogen testing programs for raw beef trim. The methods compared were N60excision, N60plus, Continuous Sampling Device (CSD), and Manual Sampling Device (MSD). Trim from two lean:fat ratios were evaluated (50:50 and 80:20). Each sampling method was performed on single 900-kg combo bins in a commercial beef processing plant. All combo bins were tested by all four methods.

The CSD samples were collected using the Pathtect™ CSD with the Micro-Tally™ cloth. The sampler was mounted at the end of the two trim conveyor lines and samples were collected as the trim pieces fell into the combo bin. The other three sampling methods were performed by personnel with extensive experience with the sampling methods after the filled combo had been relocated to a sampling area.

A total of 94 combos of 50:50 trim and 91 combos of 80:20 trim were sampled over four different days. Samples were stored at 4°C for up to 24 h before processing. Tryptic soy broth was used as the bacterial growth media for all samples. Analyses performed were split into enumeration of indicator bacteria counts (aerobic plate counts: APC and Enterobacteriaceae counts: EBC) and prevalence of PCR targets representative of STEC-like organisms (hemolysin, intimin, O serogroup). The O serogroup PCR is the combined data from five individual, non-STEC-specific O serogroup PCRs: O55, O113, O117, O126, and O146. The enumeration data were tallied on a per sample basis and reported as log CFU/sample. APC data were analyzed by repeated measures one-way analysis of variance with multiple pairwise comparisons of means using Tukey-Kramer test method with the probability level at $P \leq 0.05$. EBC data were analyzed by one-way analysis of variance with multiple pairwise comparisons of means using Tukey-Kramer test method with the probability level at $P \leq 0.05$. Prevalence data were tallied as positive or negative for the specific PCR targets and reported as the proportion of positive samples. Prevalence data were analyzed with Fisher's exact test using multiple pairwise comparisons.

Results

There were no statistically significant differences ($P > 0.05$) between any of the four methods in recovery of APC from 50:50 lean point samples. For the 80:20 lean point samples, the N60 plus and N60 excision methods were equivalent ($P > 0.05$) to each other in APC recovery. The N60 excision method resulted in higher ($P \leq 0.05$) APC totals than either the CSD or MSD methods. N60 plus was equivalent ($P > 0.05$) to MSD, but recovered more ($P \leq 0.05$) APC than the CSD method. In 50:50 trim samples, the N60 excision method recovered more ($P \leq 0.05$) EBC than the MSD or N60 plus methods, but was equivalent ($P > 0.05$) to the CSD method. The CSD method was equivalent ($P > 0.05$) to all three other methods in recovery of EBC from 50:50 trim. For 80:20 trim, the increased EBC recovery by the N60 excision method was statistically significant ($P \leq 0.05$) when compared to the other three methods. The prevalence of the hemolysin gene target was higher ($P \leq 0.05$) using the CSD compared to MSD and N60 plus. The difference between the hemolysin prevalence for the CSD and N60 excision methods was not statistically different ($P > 0.05$). MSD was not different ($P > 0.05$) for hemolysin gene detection than either N60 excision or N60 plus. There were no significant differences ($P > 0.05$) between any of the four methods in detecting the intimin gene target. The MSD method prevalence of the combined O group targets was higher ($P \leq 0.05$) when compared to the N60 plus method, but equivalent ($P > 0.05$) to the CSD and N60 excision methods.

Conclusion

This evaluation provided evidence that the four sample collection methods were essentially equivalent in recovery of indicator organisms counts and prevalence targets from raw beef trim.

Notes